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ABSTRACT

Seychelles Integrated Science (SIS), a 3-year laboratory-based science program for students (ages 11-15) in upper primary grades 7, 8, and 9, was developed from an extensive evaluation and modification of previous P7-P9 materials. This P8 SIS unit focuses on: (1) the uses of acids and bases (alkalis) in students' everyday lives, stressing their use at home, at work, and in the body; (2) the chemical properties of acids and bases; (3) the concept and use of the pH scales as a means of measuring acidity and alkalinity; and (4) concepts concerning the differing reactivity of metals and chemical reactions. Provided for the unit is a student workbook and a set of teaching notes. The teaching notes include the general aims of the unit, and a lesson plan for each topic area. Each lesson plan includes a suggested time frame, a list of objectives, a list of equipment needed, and a suggested lesson format. This format includes suggestions for introducing the lesson, instructional strategies (emphasizing procedures for student activities), and evaluation methods. The student workbook includes procedures for completing the unit activities and a list of new words keyed to page numbers in the workbook. (JN)

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seychelles integrated science

Unit 9

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TEACHING NOTES

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The Goals of Unit 9

In the Unit "acids and alkalis" we begin by introducing the pupils to the basic concept of what an acid is. We do NOT expect pupils at this level to learn about acids in terms of free hydrogen ions , rather we want to develop their knowledge and understanding using concrete and direct observation of the effects of acids. They taste sour, they change colour of indicator solution, they act on carbonates etc. We also introduce the concept of alkalis and PH scale in the same way. Through out the unit we ask you whenever and wherever possible to relate the chemicals and ideas you are using to the pupils everyday life and to stress the idea that acids and alkalis are everyday chemicals that we use at home, at work and in our bodies.

Overall Unit 9 has four main Goals

1) To make the pupils aware of and familiar with the use of acids and alkalis in our everyday lives.

2) To develop in the pupils an elementary understanding of the properties (or characteristics) of acids and alkalis.

3) To introduce the pupils to the concept and use of the PH scale as a means of measuring acidity and alkalinity.

4) To develop in the pupils an elementary understanding of the concepts of:
   (a) the differing reactivity of metals
   (b) chemical reactions

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LESSON PLAN

Unit 1 Topic 1

About Acids

Time Two to three periods

Objectives At the end of the Topic the pupils should:

(1) know that acids taste sour.

Be able to:

(2) use an indicator to test a liquid to see whether or not it is an acid.

(3) recall four everyday substances which are acids.

(4) recall an everyday use of sulphuric acid and hydrochloric acid.

(5) explain in their own words that "strong" acids turn (universal) indicator red or pink and "weak" acids turn it yellow.

(6) be aware that we must take care when working with strong acids.

Equipment Each pair or group of pupils will need:

- six test-tubes and a test-tube rack
- some universal indicator either 10ml of liquid or 4-6 sheets from a indicator booklet
- a test dropper
- a petri or crystallizing dish
- a half a spatula full of citric acid

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You will also require/beakers containing vinegar, limonade, lemon juice and mango juice. (Any other fruit juice available), and a number of neutral "solutions" such as water, salt and sugar.

- and labelled bottles of sulphuric, hydrochloric and nitric acid.
- a little (conc) nitric acid and a 10 cent coin in an evaporating basin.

Suggest Lesson Format

Write the word "ACID" on the board. Pronounce the word and ask if anyone has ever heard of the word before. Then ask a number of pupils to explain what the word means - and to name some thing which they would CALL acid.

Activity

Let each pupil wet their finger and dip it into their dish of citric acid. Then get them to taste the acid. Ask one or two pupils to describe what an acid tastes like (objective 1)

Let everyone read section 1.2 show them how to use the indicator paper (or solution) and then let them carry out the activity. Ask the pupils to say what happens to the indicator when it touches the acid. Ask them how they could use indicator to find out whether or not a substance was an acid.

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Draw up a table on the board similar to the one below and get each pupil to copy it into their book.

Substance	Colour of Indicator with this substance	Is the substance an acid
Vinegar Lemonade Salt water Lemon juice Tap water Sugar water Orange Juice		

Get each group to test each of the substances, and to write down the colour of the indicator with each substance and then to decide whether the substance is an acid; "yes" or "no".

Complete your table on the board by asking one group to say what their result for a substance was and then checking to see how many groups agree. If there is a disagreement allow the two groups who disagree to both demonstrate how they got their result.

From the Table ask the pupils to select 4 things which are acids (objective 2&3)

Discussion and Evaluation

Explain to the pupils that besides the acids that we may use in the home that there are also other acids which are usually more powerful and are used in car batteries and in making fertilizers.

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A "weak" form of one of three acids is also in our stomach. Write the words - sulphuric acid, hydrochloric acid and nitric acid on the board and get the pupils to copy these and write down a few words about each.

e.g. Sulphuric acid - used in batteries.

Test the three acids with the indicator and let individual pupils add the results to the table on the board.

Get the pupils to read section 1.5. Then sketch a summary diagram such as the one below on the board.

Indicator	
Red or Pink	——————————→ Strongly acidic
Yellow	——————————→ Weakly acidic

Get the pupils to copy this diagram into their books and then to add in the names of two substances which are "strongly acidic" and two that are "weakly acidic" (objective 5)

Finally explain to the pupils the dangers of working with strong acids. If you have some concentrated acid you may like to demonstrate the action of the acid on a plastic cup or on a 10 cent coin. Emphasize to the pupils the need to take care when working with acids (objective 6)

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LESSON PLAN

Unit 9 Topic 2

About Alkalis

Time Two to three periods

Objectives At the end of the Topic the pupils should:

(1) know that soap turns indicator dark green or blue

(2) know that alkalis feel soapy

(3) be able to use an indicator to test a liquid to see whether or not it is an alkalis

(4) recall <u>four</u> everyday substances which are alkalis

(5) be able to explain in their own words that "strong" alkalis turn (universal) indicator a mauve or purple colour and "weak" alkalis turn it dark green or blue

(6) be aware that we must take care when working with strong alkalis.

Equipment Each group of pupils will need:

- a small piece of soap
- a test dropper
- six test-tubes and a holder
- some indicator solution or indicator paper

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You will need a selection of solutions of washing powder, bleach, tooothpaste, bicarbonate and some salt and Sugar solutions.

You will also need labelled bottle of sodium hydroxide and ammonium hydroxide.

Suggested Lesson Format

Introduction

Revise with the pupils what they have learned about acids. (Topic objectives 1&6) Ask whether they think soap is an acid or not. Allow a few pupils to answer and to give reasons for their answers

Activity

Let everyone read section 2.1 and then rub a piece of wet soap between their fingers. Get each pupil to <u>think</u> of a sentence of two or three words to describe the feel. Let 5 or 6 say what their sentence is. You should write one or two of the most appropriate on the board.

Let everyone read and then copy out section 2.2. Ask each group to say (or write down if able) sentences about:

(1) What happens to the colour of the indicator.

(2) Why they think that soap is or is not acidic.

Write one or two of the groups replies on the board (objective 1&2)

Let the pupils read sections 2.3. Than give clear instruction on how the groups are to carry out the activity. Warn the pupils that some alkalis can be dangerous and "burn" the skin so they must take care when working with them. (objective 6)

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Draw a table on the board similar to the one below and get the pupils to copy it into their books.

Substance	Colour of Indicator with this substance	Is the substance an alkalis?
Sugar solution Bleach Toothpaste - (solutions) Salt solution Bicarbonate Soduim - hydroxide Ammonuim - hydroxide		

Let each group carry out the activity and complete the table. (objective 3)

Let each group call out their answers and use these to complete the table on the board. Ask the pupils if they can name some substances which are alkalis (objective 4)

Explain that strong Alkalis turn indicator purple or mauve and ask them from their results can they pick out any substances which are strong alkalis. (objective 5)

Discussion and Evaluation

Revise the 6 objectives with the whole class and then get them to write a short note about alkalis. More able classes may only need to use the notes you have on the board, other classes may need more guidance, e.g. key words and phrases. For pupils with low ability in English.

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You can get them to complete sentences using "missing" words. e.g. Fill in the missing words.

Acids taste ----------. Alkalis feel ----------.
Indicator becomes a --------- or -------- colour when you add weak alkalis to it. ---------- and ---------- are two examples of alkalis that we use at home. Bleach is a strong alkalis and will change the colour of indicator to ----------.

Blue, toothpaste, sour, purple, soapy, washing powder and green.

Unit 9 Topic 3

Acids, Alkalis and PH

Time Three to Four periods

Objectives At the end of the Topic the pupils should:

(1) know that substances which are neither acid nor alkalis are neutral.

(2) be able to recall 3 everyday substances which are neutral

(3) be able to use an indicator to test a liquid to see whether or not it is neutral.

(4) Use an indicator to find the pH of some everyday liquids and be able to identify those which are strongly or weakly acidic, these which are strongly or weakly alkalis and those which are neutral.

Equipment Each group of pupils will need:

- 6 test-tubes and a test-tube rack
- some indicator paper or solution
- a colour chart for the indicator paper or solution

Some crayons or felt tip pencils. You should have solutions of:

salt, sugar, baking powder, lemonade, bleach, soap, hydrochloric acid, shampoo, vinegar, soduim hydroxide and some soap water, distilled water, sea water and saliva.

You should also have some coloured chalk (red, yellow, green, blue and purple) or else a poster showing the colours of the pH scale.

Introduction

Revise previous work about acids or alkalis. Ensure that the pupils remember the colour changes in universal indicator for acids and alkalis. Ask the pupils to check their records for Topics 1 and 2 to see if sugar and salt were either acidic or alkaline.

Activity

Let the pupils read sections 3.0 and 3.1 and then discuss it with you.

Draw a table on the board similar to the one below and get the pupils to copy it into their books.

Substance	The colour of the indicator with this substance	Is the substance neutral?

Let the pupils carry out the activity and record their results into their table. When each group has finished the activity write the following sentences on the board and ask each pupil to complete them in their books.

The indicator is a ------- colour when we put a neutral substance with it. In the experiment we tested some substances with indicator.

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We found that two of the things that were neutral were ---------- and ----------.
(objectives 1 and 2)

When the pupils have completed this. Ask them to look back over their results for Topic 1, 2 and 3 to see how many different colours that they get with the indicator. Allow individuals to call out the different colours and write them as a list on the board.

Then "link" each colour with a two word description e.g.

Red -------- ------ Strongly acidic

Yellow ---------- Weakly acidic

Explain that scientists have a special scale they use when talking about acids and alkalis - the pH scale.

Strong acids will have a pH of 2, 3 and 4. Neutral substances such as water and salt solution will have a a pH of 7 and strong alkalis will have a PH of 10 or 11.

Fill these numbers in your table on the board and then ask the pupils to suggest what PH a weak acid and a weak alkalis would have.

Complete your PH table on the board similar to the one in the pupils booklet page 6. Use chalk to colour in each block its correct colour - or use a "POSTER" with the blocks already coloured in.

Get each pupils to draw and colour a PH strip into their books with coloured crayons.

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Draw a table similar to the one below on the board and get the pupils to copy it into their books.

Substance	Terms Indicator	pH	IS
Vinegar	Yellow	5	Weak acid

Allow each group to the test and find the pH of a range of about 6 or 7 different susbstances (objective 4)

Discussion and Evaluation

As the groups carry out the activity you and the technician should move from group to group. Check that each pupil understands the activity and can explain how to test for pH and how to interpret the results.

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LESSON PLAN

Unit 9 Topic 4

Acids and Carbonate

Time Two to three periods

Objective At the end of the Topic the pupils should:

(1) know that coral and shells are made of calcium carbonate

(2) know that if "strong" acids are added to calcium carbonate , the gas carbon dioxide will be given off.

(3) be able to produce carbon dioxide gas (by adding hydrochloric acid to calcium carbonate) and test for the presence of the gas by using lime water.

You will need two or three pieces of coral and some sea shells.

Equipment Each group of pupils will need:

- two test-tubes
- a small piece of coral
- a teat-dropper
- about 20ml of dilute hydrochloric acid
- about 5 - 10ml of lime water
- about 1/2 a spatula of calcium carbonate

Suggested Lesson Format

Introduction Try and arrange with the pupils that They bring in some shells and coral. Allow a few minutes for the pupils to pass around, look and talk about the different pieces.

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Ask if anyone knows what coral is made of. From the discussion bring out the idea that coral is made from the sea shells of millions andmillions of tiny naimals.

Activity

Let everyone read section 4.1. Then get each group to add a few drops of acid to the coral in test-tube. Get the pupils to observe what happens in the tube and then to describe what they observed. Allow two or three pupils to describe this and write down the most appropriate description on on the board. Repeat this with a piece of broken shell.

Let the pupils read section 4.2. Show the bottle of clacium carbonate and write the name on the board. Ask one group to demonstrate to the class what they are going to do and let the rest of the class judge whether or not they are right. (objectives 1 and 2) Get each group to carry out the activity.

Discussion and Evaluation

You and the technician should move from group to group asking them to explain what they are doing, what they ibserve ahd what they understand or learn from this.

From the discussionslist a number of key words or phrases on the board, for example:

coral, shells, tiny animals, calcium carbonate hydrochloric acid, gas carbon dioxide, lime water, milky.

Get each group (or pupil) to write a sentance or two about acids and carbonates using these words.

For pupils in lower streams or those who have problems with English you might prefer to get them to "fill in the missing words" in a sentance or two.

"Coral is made from the shells of _____ _____ Coral and shells are both made from a chemical called _____ _____. If you add hydrochloric acid to this chemical it will give off a gas called _____.

LESSON PLAN

Unit 9 Topic 5

Making salts

Time About three periods

Objectives At the end of the Topic the pupils should be able to:

(1) recall that soduim hydroxide is an alkali.

(2) neutralize a soduim hydroxide solution with hydrochloric acid using a teat-dropper and indicator.

(3) Make common salt (soduim chloride) by neutralizing soduim hydroxide with hydrochloric acid and evaporating the resultant solution

(4) explain in their own words that when an alkali is neutralized with an acid, a salt and water will the formed.

Equipment Each group of pupils will need:

- a test-tube
- a teat dropper
- a evaporating basin
- a bunsen burner, tripod stand and gauze.
- about 4ml of dilute soduim hydroxide
- abut 5ml of dilute hydrochloric acid.

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Suggested Lesson Format

Introduction	Revise with the pupils the work they did in Topic 4. In the discussion bring out on the board that they added one chemical (hydrochloric acid) to a second chemical (calcium carbonate) One chemical affected or reacted with the other and gave of a gas (carbon dioxide).
Activity	Let everyone read section 5.0, discuss this and write the words "CHEMICAL REACTION" on the board. Ask everyone to read section 5.1. Allow each group a few minutes to discuss what they are going to do and then let one group demonstrate what they will do. When you are satisfied that everyone understands what to do, let each group carry out the activity. You and the technician should move from group to group checking on their work. (objective 2). As each group finishes let them read section 5.2. Then discuss with the group what they propose to do and how this will differ from what they did in 5.1. Let them then carry out the activity. When the salt has cooled down let each group taste it using their finger tip. (objective 3)
Discussion and Evaluation	Put the words "sodium hydroxide" "neutral" "neutralize" "hydrochloric acid" on the board. Ask the pupils if anyone can explain what the experiment was "all about" "what happened in it?" Allow a few pupils to discuss their ideas and use the most appropriate to sketch out a summary on the board.

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Hydrochloric Acid (ACID)
Reacts with +
Sodium hydroxide (ALKALI)

Gives

Sodium chloride	Salt
And	+
Water	Water

Let the pupils copy this summary down. And then let them write one or two lines about what they did in the experiment. Use key words or sentence completion if it is needed.

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LESSON PLAN

Unit 9 Topic 6

Acids in your body

Time Four to five periods

Objectives At the end of the Topic pupils should:

(1) know that there are acids in some parts of our body

(2) be able to demonstrate that our breath is slightly acidic - using a test-tube, straw and some indicator solution.

(3) be able to explain in their own words that indigestion in often caused by having too much acid in our stomaches and it can be "cured" or neutralized by taking a weak alkali such as sodium bicarbonate (baking soda)

(4) be able to test plaque to show that it is acidic

(5) be able to explair in their own words that toothpaste is alkaline and that we use it to neutralize the acidic plaque which would otherwise damage our teeth.

Equipment Each group of pupils will need:

- a test tube, straw and about 10ml of indicator solution.
- a petri or crystalizing dish
- a spatula of sodium bicarbonate and about 5ml of hydrochloric acid.
- a tooth pick (or cocktail stick)
- about 5ml of distilled water and some indicator

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You will also need a tube of toothpaste and one or two boxes of different "stomach powders" such as Enos.

You should also have one or two disclosure tablets (available from the Science Centre)

Suggested Lesson Format

Introduction

Ask if anyone in the class has been sick and vomiting recently. Ask the pupils concerned if they know what made them sick. Allow a few minutes for discussion and then ask the class if anyone can describe the "taste" of vomit. Allow a few pupils to give their suggestions and then bring out the idea that it tastes sour. Remind the pupils that this is one of the characteristics of acids and hence that vomit itself is acidic.

Activity

Tell the pupils that "some people" say that our breath is acidic and then ask them "How could we find if it is or not?" Ask each group to try to think of something they could do to find out whether or not their breath was acidic. Allow them a few minutes for discussion. You adn the technician should move around from group to group helping them "plan" what to do.

Discuss the ideas suggested by the group with the pupils.

Then "form a plan" for the whole class. We suggested that you get someone from each group to simply keep blowing into a test-tube which has a little indicator solution in it until there is a colour change in the indicator.

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Ask a number of pupils to describe to the class what they've done and what the experiment has shown. (objectives 1 and 2)

Let the pupils read section 6.2. Ask pupils what do they or their parents take if they have a "sore" stomach. Allow one or two to talk about this and then pass around the bottles or boxes of stomach powder you have. Point out the alkali on the label of each or test it with an "indicator paper".

Give each group the petri dish with hydrochloric acid in it and ask them to keep adding the bicarbonate and testing it with indicator paper (or solution). Moving around from group to group asking the pupils to explain what they are doing and what is happening. (objective 3)

Revise the idea that we have acids in our stomach and acid in our breath. Tell the class that often we also have acid on our teeth. Explain that after we eat, particles of food often stick to our teeth, particularly at the edge of our gums and between the teeth. This food rots and will leave a covering of plaque (or rotting food) on the teeth.

Get one pupil to chew the disclosure tablet, spit it into sink and show his teeth to the rest of the class. The parts stained red and blue show where plaque has collected.

Allow each group a few minutes to plan and discuss what they are going to do and then let them carry out the activity. Move around from group to group discussing their results (objective 4). Ask the pupils to suggest ways they could stop the acid from attacking their teeth. Develop the idea that we can remove the plaque and then neutralize the acid with a mild alkalis.

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Ask the pupils to test a sample of toothpaste to see whether or not it is an alkali. (Show them how to dissolve a little toothpaste by shaking it with some distilled water in a test-tube).

Discussion and Evaluation

Ask each group to prepare a statement about why we should clean our teeth and why we use toothpaste to do it. Allow each group a few minutes to prepare their statement and then get two or three groups to tell or read out their statement to the rest of the class. Wrote the best one on the board. (objective 5)

Get each pupil to "draw a picture" into their books showing plaque on teeth and then copy down the statement from the board.

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LESSON PLAN

Unit 9 Topic 7

Acids and metals

Time Three to four periods

Objectives At the end of the Topic the pupils should be able to:-

(1) explain in their own words Three properties of acids
   (a) they change the colour of indicator to yellow or red.
   (b) they react with carbonates to produce carbon dioxide
   (c) they neutralize alkalis to produce water and salts

(2) Carry out an experiment to demonstrate that when an acid (e.g. hydrochloric acid) is added to zinc metal, hydrogen gas is given off.

(3) identify a test-tube of hydrogen gas by "popping" it with a flame.

more academically-orented pupils should also be able to:

(4) explain in their own words that acids react with metals to give hydrogen and that some metals are "more reactive" than others.

(5) Given a list of 7 metals (sodium, potassium, calcium, magnesium, iron, copper and lead), be able to identify which three are "least reactive" with acids

Equipment

Each group will need:

- a sheet of paper and use of scissors
- two test-tubes
- about 10 - 15ml of (dilute) hydrochloric acid
- a splint or coconut twig
- a spatula full of each
- of the following;

  granulated zinc, magnesium powder or ribbon, iron filings, copper powder or turnings and lead pieces or powder for demonstration.

You will need a trough of water and small pieces of sodium, potassium and calcium (pieces about the size of a grain of rice).

Suggested Lesson Format

Introduction

Revise with the pupils the properties of acids that they have learned about. Revise the 3 properties given on page 11 - you can also mention the "sour" taste as another characteristic although we do not use this often because of the danger of tasting a strong acid.

Use the pupils' own words to draw up a list of the properties of acids on the board. Get the pupils to write this list into their books. (objective 1)

Activity

Let the pupils read section 7.1 make sure that everyone is clear about what to do and then let each group carry out the activity. You and the technician should more around from group to group checking what each does and asking them to describe what happens.

Bring out the point that the hydrochloric acid and zinc or "Acting" together and producing a gas - hydrogen.

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Let everyone read section 7.2. Demonstrate what the pupils should do - without "popping the hydrogen". Then let each group carry out the activity.

Allow each group a few minutes to discuss and prepare a statement on "what you have learned from the activity". Let each group report and then you should write one or two of the statements on the board.

In the discussion bring out the point that hydrochloric acid and zinc "act" together to make or form hydrogen gas. The test for hydrogen gas is to set a little of it alight in a test-tube to see if it will burn with a "pop". (objectives 2 and 3)
Tell the pupils that they are going to test a number of different metals to see if they will also act with hydrochloric acid to make hydrogen gas.

Draw the table from page 12 of the pupils' books on the board and fill in the list of the metals that you want the pupils to test. Get them to copy this into their books.

Discuss what you want the pupils to do and check that everyone understands. Carry out the activity and write up their results into their table. You and the technician should move around from group to group checking on their work and discussing the results.

Let the pupils read section 7.5 and then demonstrate what happens when sodium, potassium and calcium are added to water. Explain that we must use water because these metals are so reactive that they would explode if we put them in acid. Get the pupils to record the results for these three metals into their table. (objective 4)

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Discussion and Evaluation

Give a sheet of paper out to each group. Get them to cut the sheet up into about 10 slips and then to write the name of each metal they have tested on a separate slip.

When they have done this ask each group to "Rank" the metals according to which one "Reacted" most strongly with the acid (or water).

You and the technician should move around the groups discussing with them why they place the metals in the order they do.

Work out an agreed list on the board then get pupils to write this down into their books. (objective 5)
Ask each group to prepare a verbal report on what they did and to present their report to the class. Write one or two sentences, (as far as possible using the pupils own words) on the board and get the pupils to write their own reports based on this. With weak classes you may prefer to get them to simply fill in missing words in sentences you write for them.

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LESSON PLAN

Unit 9 Summary 1

Chemical Reactions

Time Three to four periods. We suggest this summary is suitable only for more academically oriented pupils.

Objectives At the end of the Topic the pupils should:

(1) know that when two chemicals react together they form a product or products.

(2) be able to identify one main product resulting from the reaction of hydrochloric acid with each of the following;

sodium bicarbonate, sodium hydroxide and zinc metal.

(3) know that hydrogen is a gas which is lighter than air, burns easily and will react with, oxygen to form water.

(4) be able, given an equation of two chemicals and their product(s), to apply their knowledge of reactions by identifying the chemicals which are reacting together and the product(s) of their reactions.

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Equipment

Each group of pupils will need:

- 4 test-tubes
- about half a spatula of granulated zinc
- 5 - 10 ml of hydrochloric acid
- half a spatula of sodium bicarbonate
- a burner

Suggested Lesson Format

Introduction

Write the words hydrochloric acid and sodium bicarbonate Ask the pupilsif anyone can remember what happens when hydrochloric acid meets or "reacts" with sodium bicarbonate. Allow a few pupils to discuss their ideas.

Activity

Let each group "revise" the activity by adding one or two drops of the acid to a half spatula of bicarbonate in a test-tube.

Allow a few to report or confirm what they observed. Write on the board the words

hydrochloric Acid + sodium bicarbonate ------->

Ask the pupils to suggest what you should write at the end of the arrow. Allow one or two to give their ideas and then let a pupil write the word carbon dioxide. Repeat this for the other reactions. In your discussion stress the words reactions and product.

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Rub out the "products" section on the board and then ask the pupils to write the three reactions into their books and fill in the products section themselves. You and the technician should check on their work as they do so. Tell the children that for the next experiment they will need to make a test-tube of hydrogen gas again. Ask if anyone can remember exactly how to do it. Allow one or two pupils to demonstrate this. Let them actually make the gas and "pop" it.

Explain to the pupils that you want them to do the same thing only they must "pop" the hydrogen in a dry test tube. Demonstrate how to dry the tube over a burner flame.

Let the pupils carry out the activity but advise them that [illegible] to look at the inside of the test-tube after they pop it.

Discussion and Evaluation

You and the technician should move around from group to group asking the children to describe what they see in the test-tube and to suggest what it might be.

Ask one or two groups to report on what they did. From the discussion bring out the point that the hydrogen gas reacts with oxygen in the Air when it burns, and that the product is Water.

Hydrogen and Oxygen ------▶Water. Use key words on the board and get the pupils to write one or two sentances about what they did in their books. For weak classes you may prefer to let them fill in the missing words in sentances you write on the board.

---oo0oo---

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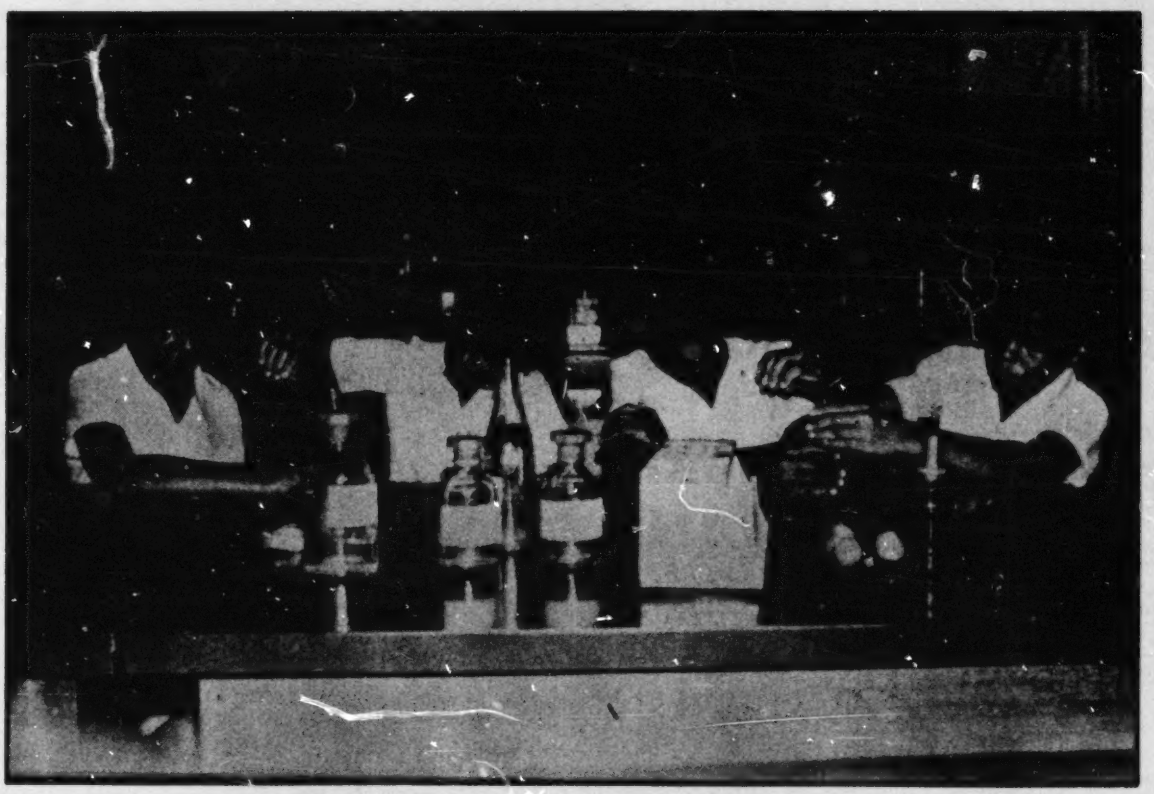
SEYCHELLES INTEGRATED SCIENCE

Unit 9



SE045068

ACIDS AND ALKALIS

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R E P U B L I C O F S E Y C H E L L E S

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UNIT 9

TOPIC 1

ABOUT ACIDS

1.0 In this unit, we are going to learn about ACIDS. You may have heard the word "acid" before. Write down what you already know about acids.

1.1 Now we shall try to find out more about an acid called citric acid. Your teacher may give you some citric acid to taste.

** YOU MUST NOT TASTE ANY OTHER ACIDS **

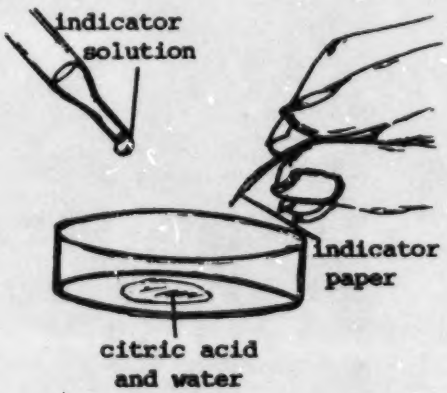
Wet your finger and pick up a little citric acid on it. Put this acid on your tongue.

Describe the taste of the citric acid.

1.2 We have learnt one special thing about, or one "property" of, citric acid; it has a sour taste. Now we shall use a special chemical called an INDICATOR to find out about another property of citric acid.

Mix some citric acid with a little water until the acid dissolves. Add some "indicator" (paper or solution).

Describe what happens to the colour of the indicator.



UNIT 9

TOPIC 1

ABOUT ACIDS

1.3 Scientists know about many different acids. Some acids are man-made, others are natural (e.g. we get citric acid in the juice of fruits like lemons and oranges). Now we shall try to find out how some of these different acids affect a special indicator, called UNIVERSAL INDICATOR.

1.4 Add some of the universal indicator to a little of each of the following:
vinegar, lemonade,
fruit juice (of lemons, mangos etc...)

Record the colour that you see with each of these.

You may also like to try some laboratory acids:
sulphuric acid (which we use in car batteries)
hydrochloric acid (which is also a "natural" acid in very dilute form found in our stomachs)
nitric acid (which we use to make fertilisers)

** YOU MUST BE VERY CAREFUL WITH ALL ACIDS IN THE LABORATORY **

1.5 Some of the acids you used in experiment 1.4 are more strongly acidic than others. A red or pink colour with universal indicator means that the acid is strongly acidic. A yellow colour means that it is weakly acidic. Use the results from your experiment to make two lists in your book:

THINGS THAT ARE STRONGLY ACIDIC	THINGS THAT ARE WEAKLY ACIDIC

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UNIT 9

TOPIC 2

ABOUT ALKALIS

2.0 In Topic 1, we learnt about two properties of acids. They have a sour taste, and they can change the colour of universal indicator to red or yellow. However, there are many things which are <u>not acidic</u> at all, for example soap.

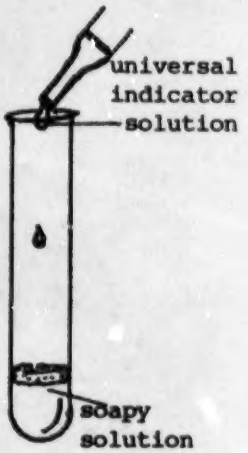
2.1 Wet a small piece of soap. Rub it between your fingers.

Describe how it feels. Write down anything else you can think of which also feels "soapy".

2.2 Mix a small piece of soap with a little water to make a soapy solution.

Put some universal indicator into a little of the soapy solution in a test-tube.

Describe what happens to the colour of the universal indicator.



UNIT 9

TOPIC 2

ABOUT ALKALIS

2.3 Soap contains a chemical called an ALKALI. Alkalis can change the colour of universal indicator, but NOT in the same way as acids.

Find out what happens if you add universal indicator to the things in this list:

washing powder, bleach, toothpaste, bicarbonate..

You may also try some alkalis from the laboratory:

sodium hydroxide
ammonium hydroxide

** YOU MUST BE VERY CAREFUL WITH ALL ALKALIS IN THE LABORATORY **

2.4 Some of the alkalis that you used in experiment 2.3 are more strongly alkaline than others. A mauve colour with universal indicator means that the alkali is strongly alkaline. A blue colour means that it is weakly alkaline.

Make a table like the one below to record your results from experiment 2.3.

	COLOUR WITH UNIVERSAL INDICATOR	STRONGLY OR WEAKLY ALKALINE ?
soap		
bleach		
sodium hydroxide		

UNIT · 9

TOPIC 3

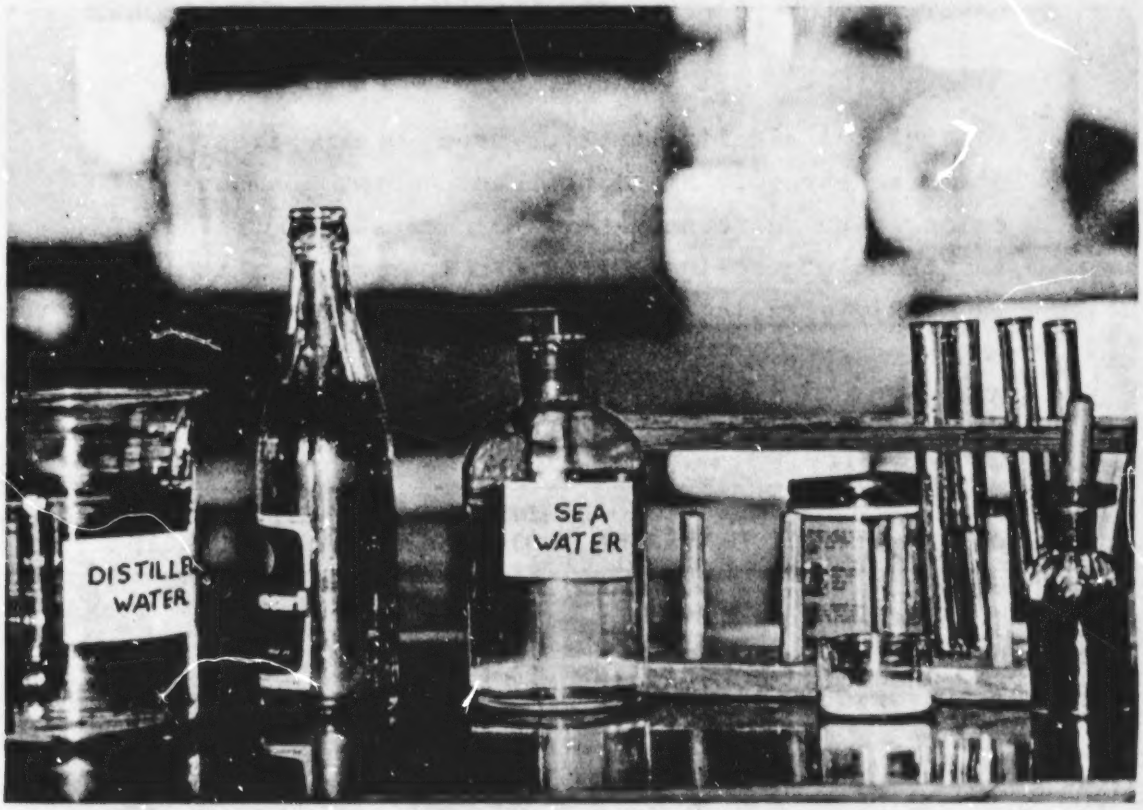
ACIDS, ALKALIS AND pH

3.0 In Topics 1 and 2, we learnt how acids and alkalis can affect the colour of universal indicator. There are, however, many things which have no such effect. These things are neither acidic nor alkaline. We say that they are NEUTRAL.

3.1 Find out if the things in the list below are acidic, neutral or alkaline:

tap water, salt, sugar, distilled water, baking powder, saliva from your mouth...

Describe what you do and record your results.



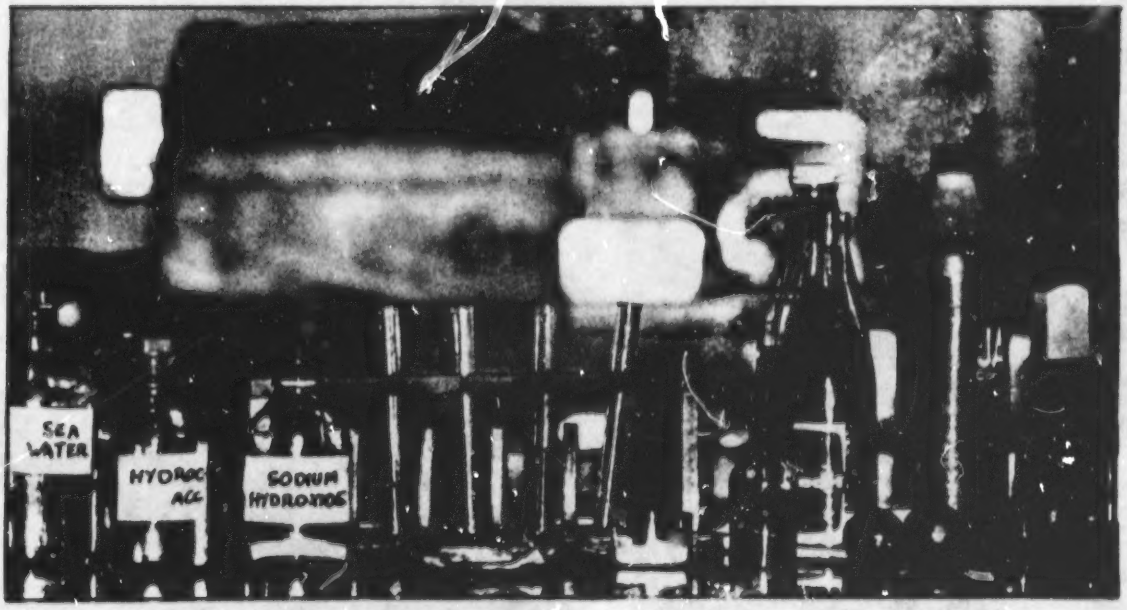
3.2 So far, we have used universal indicator to show how strongly acidic, or strongly alkaline, something is. We can also use numbers to show how strongly acidic, or alkaline, something is. We call them pH numbers

Look at the chart below. Write down which pH numbers are for acids, which is for neutral, and which are for alkalis:

RED	YELLOW	GREEN	BLUE	MAUVE
STRONGLY ACIDIC	WEAKLY ACIDIC	NEUTRAL	WEAKLY ALKALINE	STRONGLY ALKALINE
..pH3 pH4	pH5 pH6	pH7	pH8 pH9	pH10 pH11..

3.3 Use some universal indicator to help you to find the pH number for each of these:

lemonade, bleach, tap water, soap, hydrochloric acid, sea water, shampoo, vinegar, sodium hydroxide, fruit juice...



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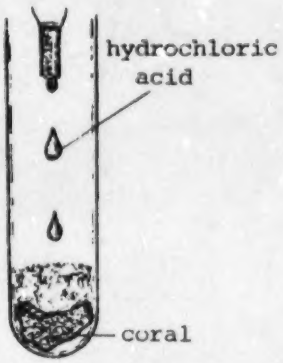
TOPIC 4

ACIDS AND CARBONATES

4.0 In Topics 1-3, we learnt something about acids, something about alkalis, and how to measure their strength or "pH". Now we shall try to find out about another property of acids.

4.1 Put a small piece of clean dry coral into a test-tube. Add a few drops of an acid (hydrochloric acid).

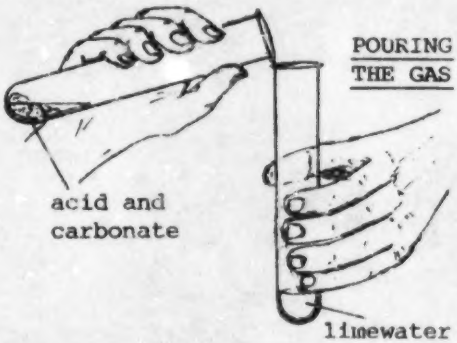


Describe what happens.

Repeat this experiment with pieces of snail shell and sea shells. Describe what happens.

4.2 Coral and shells are made of a chemical called calcium carbonate. Now we shall repeat experiment 4.1 with calcium carbonate from the laboratory, but this time we shall try to collect the gas that comes off:

Put some of the chemical that we call limewater into a clean test-tube. Then, with one hand, hold the test-tube that contains the acid and carbonate as shown. Try to "pour" the GAS into the tube that contains the limewater.



** DO NOT POUR ACID OR CORAL INTO THE LIMEWATER **

Shake the tube that now has limewater and gas in it. Describe what happens. What have you found out about the gas ?

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UNIT 9

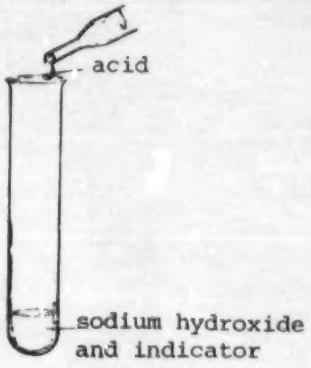
TOPIC 5

MAKING SALTS

5.0 When we added acid to the calcium carbonate in Topic 4, we saw bubbles of a gas, carbon dioxide, coming off. When one chemical affects another like this, we say that there has been a CHEMICAL REACTION. We say that the acid REACTS with the calcium carbonate.

5.1 Now we shall try to find out if acids react with alkalis. Put 2 ml of an alkali called sodium hydroxide in a test-tube. Add some universal indicator to make it a mauve colour.

Add one drop of an acid (hydrochloric acid) and shake the test-tube. Add more acid ONE DROP AT A TIME until the colour is green. (The mixture should be NEUTRAL or weakly acidic.) Count and record the number of drops of acid that you have added.



5.2 Now repeat the same experiment, but WITHOUT ANY INDICATOR. Use exactly the same amount of alkali (2 ml). Use the same number of drops of acid. When you have finished adding all the drops of acid, evaporate the mixture in a clean evaporating basin.

Describe what is left in the basin. (Your teacher may let you taste it).

5.3 The acid (hydrochloric acid) reacts with the alkali (sodium hydroxide) making WATER (which is neutral) and a SALT (sodium chloride). We say that the acid and alkali have neutralised each other. Your teacher may allow you to make some other salts using different acids and alkalis. (DO NOT TASTE THESE SALTS !)

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UNIT 9

TOPIC 6

ACIDS IN YOUR BODY

6.0 Most of your body has a natural pH which is close to neutral (pH7). However, there are some weak acids in parts of your body. Now we shall try to find out more about these acids.

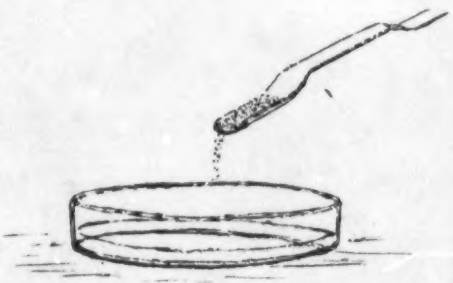
6.1 Plan an experiment to find out if the air that you breathe out from your body is acidic. (Look at the picture to help you).

Describe the experiment that you do. Record your results and try to explain them.

6.2 Have you ever had "indigestion" in your stomach ? Discuss how, or when, you can get it, and what it feels like.

You get indigestion if there is too much (hydrochloric) acid in your stomach. (Your stomach makes this acid to help you to digest your food). Some people use a powder which contains sodium bicarbonate to help cure indigestion. Do you think this would be a good idea ? Why ?

Plan an experiment to find out what effect sodium bicarbonate has on hydrochloric acid.

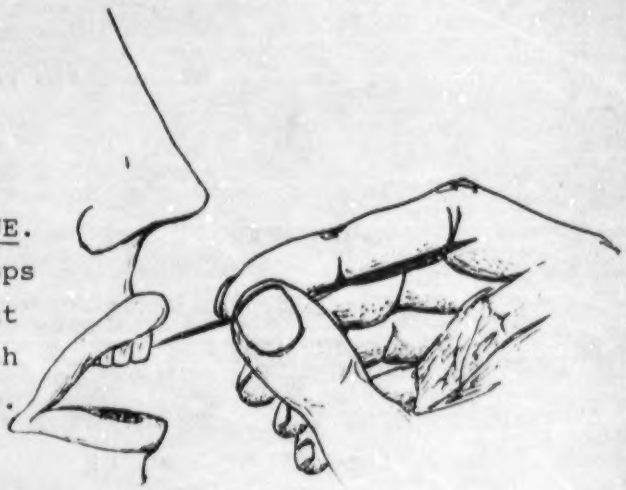


Describe what you do. Record and explain the results that you get.

ACIDS IN YOUR BODY

6.3 Your body makes the hydrochloric acid in your stomach, and the carbon dioxide in your breath. However, we do not make all of the acids that we find in our bodies.

Carefully scrape your teeth with a toothpick, or clean spatula. If you have not cleaned your teeth recently you will probably find some white material, called PLAQUE. Mix this plaque with two drops of distilled water. Find out if the plaque from your mouth is acid, neutral or alkaline.



6.4 If you leave bits of food in your mouth, microbes will grow on them. These microbes produce plaque. The acid in plaque can then react with the enamel of your teeth, and make your teeth decay.

Many people clean their teeth with a toothpaste that is alkaline. Plan an experiment to find out if toothpaste can neutralise an acid.

Describe what you do in your experiment. Record the results that you get.

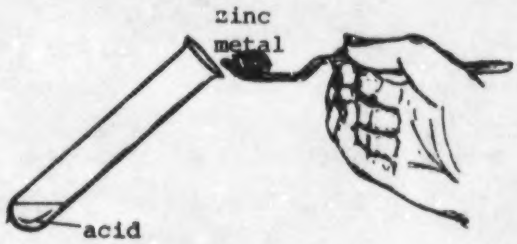
ACIDS AND METALS

7.0 So far, we have learnt about 3 properties of acids. They change the colour of indicators. They react with carbonates producing carbon dioxide gas. They react with (or "neutralise") alkalis to produce water and salts. Now we shall try to find out if acids will react with metals.

7.1 Take a small piece of the metal called zinc. (We use zinc in batteries, and for making roofs.)

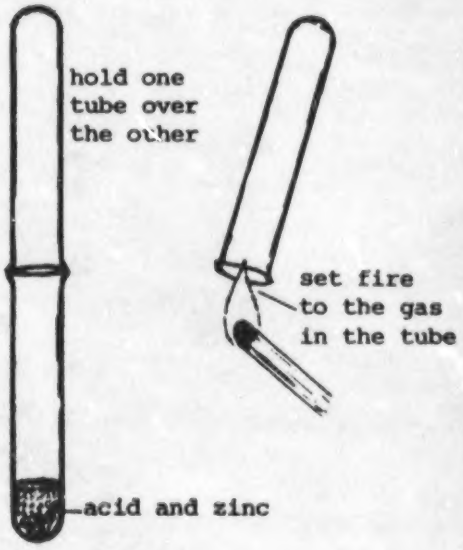
Describe what zinc metal looks like.

Put the piece of zinc into about 2 ml of an acid in a test-tube. Describe what happens.



7.2 Repeat the same experiment but this time hold a clean dry test-tube over the top. (as the picture shows). Hold it there for about 15 to 30 seconds to collect some gas.

Then put a flame (of a match or splint) under the upper tube.
Describe what you hear.



ACIDS AND METALS

7.3 We have learnt that the metal zinc reacts with acid. The reaction produces a gas, which we call HYDROGEN.

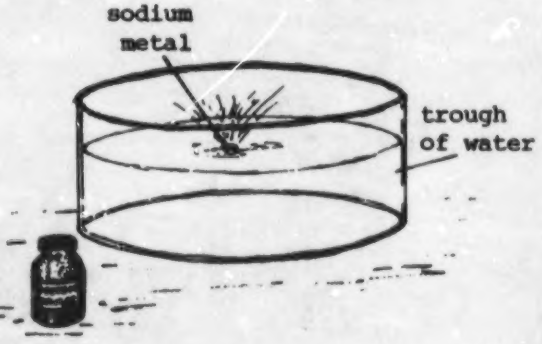
Find out if you get the same reaction with other metals, for example iron and magnesium. Draw a table in your book to record the results of all the experiments that you do with acids and metals:

NAME OF METAL	DESCRIPTION OF METAL	DESCRIPTION OF REACTION OF METAL WITH ACID
zinc		
iron		
⋮		

7.4 Some metals react more with acid than others. We say that these metals are more "reactive". Other metals may not react with acids at all. Do an experiment to find out if the metals copper and lead react with acid.

7.5 Your teacher may show you some metals that are very reactive - they even react with water (for example sodium, calcium, potassium).

Describe what these metals look like, and what happens when they react with water.



7.6 Make a list of all the metals you have just used or seen. Start with the most reactive and end with the least reactive.

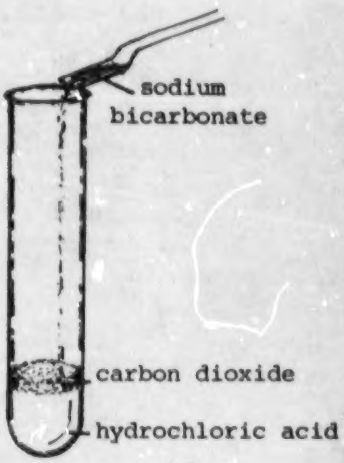
UNIT 9

SUMMARY 1

CHEMICAL REACTIONS

1. In this Unit, we have done many experiments in which there were chemical reactions. In Topic 5, we learnt that when two chemicals affect each other, there is a chemical reaction.

For example, hydrochloric acid reacts with sodium bicarbonate. This reaction produces a gas, carbon dioxide. We say that the carbon dioxide gas is a PRODUCT of this reaction.



We can write the reaction like this:

CHEMICALS THAT REACT				PRODUCT(S)
hydrochloric acid	+	sodium bicarbonate	⟶	carbon dioxide

Write down a product for each of the reactions below:

hydrochloric acid + sodium bicarbonate ⟶

hydrochloric acid + sodium hydroxide ⟶

hydrochloric acid + zinc metal ⟶

[You may like to repeat the experiments to help you to remember].

2. In Topic 7, you made a gas called HYDROGEN. It is a very light gas, and was once used to fill balloons. If we set fire to hydrogen, it burns with a loud noise. It reacts with the oxygen in the air.
Set fire to some hydrogen in a dry test-tube. Describe what you can see on the inside of the test-tube.

Write down the product of the reaction:

HYDROGEN + OXYGEN ⟶

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